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THE NEW ECONOMIC ORDER AND INDUSTRIAL PROJECTS[1/]

by

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1/ The views and opinions expressed in this document are those of the author and do not necessarily reflect the views of the Secretariat of UNIDO. This document has been translated from an unedited original.

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I. THE NEW ECONOMIC ORDER AND THE ESTABLISHMENT OF INDUSTRIAL ENTERPRISES IN DEVELOPING COUNTRIES

A. STATEMENT OF THE PROBLEM

The knowledge of how to set up effectively performing enterprises, whether in the form of individual facilities, industrial complexes or a group of systems, is available. Such internationally renowned firms of consulting engineers as Bechtel, Lummus and the Fluor Corporation, to name only a few, can take care of both the planning and the implementation of projects.

With the evolution of technology and the internationalization of production have come new conceptual and operational approaches. It has been necessary to separate the task of conception and execution from the production function, and to make it an activity in its own right; this has led to the emergence of a new interdisciplinary profession, industrial engineering. Its major objective is to maximize the return on money invested. The result of the application of continuous processes and automation is that a production unit is no longer regarded as the juxtaposition of subsystems that can be independently studied, but as a whole, requiring a mastery of the interdependent elements of scientific, technical, technological, economic and financial knowledge necessary for planning and implementation.[1/]

This evolution has several consequences.

In the case of the developing countries, the difficulty of mastering these interdependent relationships means that for a long time to come they will have to rely on the co-operation of the advanced industrial nations for access to modern technology. The establishment of "turn-key" plants may not give rise to a genuine transfer of technology if local personnel do not receive training in industrial engineering skills. Although training for staff at the operations level[2/] plays a useful role, it is not enough to ensure the thorough mastery of projects - that is, the ability to assimilate, select and apply the information made available in the technology transfer.

1/ J. Perrin, "Engineering, technologie et fonction économique", working paper, February 1976. Organisation for Economic Co-operation and Development (OECD).

2/ The book by S. Seurat Réalités du transfert technologique describes the stages involved in the formulation and application of a method of training.

A minimum condition for success in the effort of the developing countries to achieve self-reliance[3] is that authorities responsible for projects should be fully conversant with the questions involved in the choice of technological process and with the relationships of interdependence between the financial structure of the enterprise, the selection from among technological alternatives and the choice of partners in the transfer of technology. Obviously, the local scientific and technical infrastructure in the least developed countries is too weak to take care of this strategic phase. In other developing countries the situation is different.

In the industrial countries the high performance levels that have been achieved in the production sector are today at the centre of a critical re-evaluation. The maximization of the rate of return on investments is too narrow a criterion to take into account the question of the economics of human resources.[4] The stunning social costs imposed by the real diseconomies of uncontrolled growth are today all too evident.

New social needs[5] are leading to a broader view of interdependent factors in the advanced industrial countries. In the face of a failure to satisfy social aspirations there has been a growing demand for some kind of control over technology. The concept and methods of "technological assessment" arose out of a sense of disenchantment with technology and technological progress.[6]

A new "more economical and gentler" form of growth with the promise of "some degree of control over science" has been proposed in a recent blueprint for society.[7] Thus the problem is to avoid transferring to the developing countries the negative consequences of industrialization and to take better account of these countries' real needs.

3/ "... developing countries should place a premium on self-reliance in their development effort for the realization of their full potential in terms of both human and natural resources ...", para. 49, Declaration and Plan of Action on Industrial Development and Co-operation, Second General Conference of UNIDO, 12 - 26 March 1975.

4/ François Perroux, "L'economie de la ressource humaine", Mondes en Developpement, No. 7, 1974.

5/ Harvey Brooks, Science, croissance et société, Une perspective nouvelle, OECD, 1971.

6/ François Hetman, Society and the Assessment of Technology, OECD, 1973.

7/ V. Giscard D'Estaing, Démocratie française, Fayard, 4th quarter, 1976.

The problem is very complex and there would not appear to be any solution available in the advanced industrial countries, where, for example, the monitoring of technology by society is still more a wish than a reality.

Thus, there is a need to explore fresh approaches in the light of practice and experience.

In the transfer activities accompanying all stages of industrial projects, from conception to execution, a distinction must be made between the logic of the sequences, on the one hand, and their proportions and manner of implementation, on the other.

The first is a process which, although affected by the characteristics of the specific branch of activity, evolves identically in different industries. It is linked, therefore, to the use value of the technology. The other two are conditioned by a social process, the relative strength of the partners, the adaptation of the technology, the asymmetries in the powers of decision and operation. These, then, relate to the exchange value of the technology, or rather to the "composite exchange" - that is, "a mix of free and reciprocal transfers of benefits and power relationships logically expressing an economic relationship which is, essentially, one of conflict-co-operation.[8]

The problem therefore is one of determining how to correct the present asymmetries in operational practice concerned with the conceiving, planning and implementing of industrial projects, while at the same time respecting the logic of their sequential stages.

Some initial research has already been carried out in this area.[9] [10] [11] There is an emerging trend towards new approaches to the evaluation of projects,[12] [13] and

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8/ François Perroux, Pouvoir et économie, Bordas, 1973.

9/ José Giral B., Manual para desarrollo, transferencia y adaptación de tecnología química apropriada, Universidad Autónoma de México, 1974.

10/ Francisco Sercovich, Negociación y explotación de tecnología licenciada desde el exterior: el caso de las industrias química y petroquímica, May 1975, Organization of American States (OAS).

11/ REV Papers No. 2, Research Institute for Management Science, Delft, Netherlands; translation: "La preparación de proyectos industriales", Corporación Venezolana de Fomento, Caracas, 1975.

12/ A. Bussery, Methode d'appréciation des projets dans les pays moins développés, OECD, 1973.

13/ Hartmut Schneider, National Objectives and Project Appraisal in Developing Countries, OECD, Development Centre 1975.

experience is providing fresh insights.[14/] [15/] The following remarks, summarized briefly, reflect that trend and seek to extend it and give it operational relevance.

In this paper the existing or planned enterprise is not considered as "a passive piece of the macro-economy,[16/] but as an "active unit".

An "active unit" is defined as follows: "A unit is referred to as active if, through its own actions and in its own interests, it is capable of modifying its environment - that is, through its behaviour it adapts its environment to its programme instead of adapting its programme to its environment".[17/]

The adoption of a new set of premises may lead to a fresh approach to the drawing up of projects and the provision of international technical assistance.[18/]

B. THE TARGET SYSTEM OF THE UNIDO PLAN OF ACTION

Any policy of intensified co-operation for the industrialization of the developing countries - and, consequently, the adaptation of UNIDO to the tasks concerned - must be based on the consensus decisions of the international community.

The Declaration and Plan of Action adopted at Lima therefore provide the basic guidelines.[19/]

Using the systems approach, it is possible to classify the various elements of this document in terms of aims, objectives, targets and operational variables.[20/]

14/ "Informe final del Proyecto Piloto de Transferencia de Tecnología", OAS, June 1975.

15/ Pierre F. Gonod, "Matériaux pour de nouvelles politiques du transfert technologique" ("Elements for new policies in the transfer of technology"), Revue Tiers-Monde, January-March 1976.

16/ Following an expression used by O. Gelinier.

17/ F. Perroux, Unités actives et mathématiques nouvelles - Révision de la théorie de l'équilibre économique général, Dunod, 1975.

18/ See Johan Galtung, University of Oslo, Norway, "Nouveaux concepts du développement. Nouveaux indicateurs du développement et coopération internationale", in "Pour la mise en oeuvre du Nouvel ordre économique international. Réflexions et propositions", Algiers Symposium on the New International Order, 24-27 June 1975, International Development Centre.

19/ Second General Conference, 12-26 March 1976, op cit.

20/ J. Melèse, L'analyse modulaire des systèmes de gestion (une méthode efficace pour appliquer la théorie des systemes au management), Ed. Hommes et Techniques, 1972.

The aims express ends and purposes in ethical and sociological terms. They have no direct operational application.21/

The objectives give concrete expression to the aims, analysing tasks by operational components.21/

The targets give precision to the objectives through the application of evaluation criteria accompanied by the indication of a level which is to be achieved.21/

Taken together, the aims, objectives and targets comprise the target system.

The aims of the Lima Declaration and Plan of Action may be summarized as follows:

1. The liquidation of under-development (paragraph 8); 2. Sovereignty and equality of States (paragraph 5); 3. Equitable international economic relations (paragraph 20); 4. Economic and social progress in the developing countries (paragraph 34); 5. Social justice (paragraph 58 (b)); 6. Self-sustaining and integrated socio-economic development (paragraphs 14 and 49); 7. A positive contribution to peace (paragraphs 58 (b) and 8).

Similarly, the objectives may be briefly described as follows:

1. To encourage the industry of the developing countries to increase their share [in world industrial production] (paragraph 4); 2. To modernize in part the economies of the least developed countries (paragraphs 28 and 21); 3. To eliminate all political domination (paragraph 24); 4. To eliminate socio-economic exploitation wherever it may exist (paragraph 24); 5. To transform the present structure of economic relations (paragraph 5); 6. To raise living standards (paragraph 58 (b)); 7. To eliminate unemployment (paragraph 58 (b)); 8. To eliminate the inequitable distribution of the benefits of industrialization among all sectors of the population (paragraph 58 (b) and (d)); 9. To make maximum use of local human resources (paragraph 37); 10. To establish control over natural resources (paragraph 34); To prevent environmental pollution (paragraph 39); 12. To achieve a high degree of interaction between industry and the other sectors of the economy, in particular agriculture (paragraph 58 (c)); 13. To take technological and socio-economic implications fully into account at both the planning and implementation stages (paragraph 50);

21/ J. Melèse, La gestion par les systèmes, Ed. Hommes et Techniques, 1968.

14. To strengthen the bargaining power of the developing countries, individually and collectively, as regards the acquisition of technology and obtaining fair and remunerative prices for raw materials and liberalized access to the developed countries for their manufactures (paragraph 48).

As strictly defined above, the targets are limited to a single stated goal: to ensure for the developing countries a share of at least 25 per cent of total world industrial production by the year 2000.

The operational variables are not enumerated here; they comprise the substance of the Plan of Action and, in particular, the decision to restructure UNIDO (paragraph 45).

This resumé of the target system is naturally not exhaustive, nor is the order in which the points are mentioned meant to indicate any ranking within the category.

The establishment of a ranking of importance within the target system would require additional analysis; attention would have to be given to the logical relationships between aims and between objectives, and the links between aims, objectives and targets, in order to arrive at the underlying relationships and the keys to the system.22/

Next, the analysis would inquire into the linkages and interdependences between the different levels of the target system and the operational variables envisaged, thereby permitting the identification of the most important points in the system, and sometimes of actual targets. This would subsequently make it easier to divide up programmes, order the actions chronologically and evaluate the contribution made by programmes.23/

It is clear, of course, that the target system of UNIDO's plan of action is the result of a consensus - that is, a compromise. Target systems of individual countries will differ from it to a greater or lesser extent.

22/ Pierre F. Gonod, Clés pour le transfert technologique, Institute for Economic Development, World Bank, Washington, D.C., August 1974; chapter entitled "Le système-objectif d'un mécanisme organisé national du transfert technologique".

23/ Pierre F. Gonod, Planification scientifique et technologique au Vénézuéla (la méthode d'analyse globale et d'intégration des actions), Caracas, October 1975.

In carrying out these studies, one is always struck by the gap separating the political intention or will and the real criteria used in the actual selection of industrial alternatives.

Many criteria are operationally inapplicable at the project level; this may be because they are confronted, at the sectoral level, with a factual situation at variance with the over-all framework, or they clash with the realities of the economies of private enterprise, or because they are inconsistent with the available decision-making data base, and/or because the necessary national and international tools, instruments and machinery for action are lacking.

This does not mean that the political bodies are wrong and are not articulating genuine social and national needs; it means that those concerned do not know how to bring about the conversions between macro-, medio- and micro-economies required to render the criteria operationally applicable, and that they lack the information and supporting services necessary to that end.

C. THE OBSTACLES

The Lima Declaration says that some of the obstacles which are inhibiting expansion "are of an internal structural nature" but that there also continue to exist "numerous impediments arising from colonial and neo-colonial policies or new forms of dependency" (paragraph 16).

Thus, most of the obstacles are of structural origin, whether internal or external, and have been clearly identified.

Within a systems approach, these obstacles constitute the constraints, or limitations, on the operational variables. Structural change consists, at bottom, in modifying the effects of these constraints.[24/]

These obstacles, as they affect the least developed countries, have been analysed in a remarkable UNCTAD study.[25/] The hub of this analysis is the concept of "absorptive capacity". The study says that, in what has become the conventional sense,

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24/ Cf. Barel, Prospective et analyse de systèmes DGRST, February 1972.

25/ "An assessment of constraints to development and the role of external assistance in the least developed countries", report of the UNCTAD Secretariat, Intergovernmental Group on the Least Developed Countries, 8 June 1975 (TD/B/AC.17/Misc. 1).

absorptive capacity is an inclusive concept which indicates the relative efficiency with which a country makes use of capital in terms of the various production factors; development progress is reflected by an increase in absorptive capacity. The report's author states that this notion is too narrow. Often, additional capital has been of only minor importance in the achievement of economic growth. A decisive role may be played by other production-related factors, such as technical training, scientific and technological progress, improvement in management methods, and the adaptation of institutions.

Absorptive capacity must, therefore, be understood not only from the financial point of view, but from the perspective of other capabilities as well.

Thus obstacles are caused by insufficient knowledge, skills or experience in the area of management, limitations of an institutional kind, and cultural and social constraints.[26/]

Still further impediments are: demand and market restrictions, inadequate infrastructure and shortage of complementary production factors, planning and implementation constraints to productive capital formation, and political, institutional and socio-cultural restrictions.[27/]

In the least developed countries the inappropriateness of the administrative policies and procedures of the parties providing the technical assistance represents an often overlooked cause of difficulties. Nor is this the only problem. The mechanical transfer of assistance methods underestimates the amount of aid required to permit the preparation of projects. In general, not enough allowance is made for the seriousness of the constraints affecting absorptive capacity as a result of policies of tied assistance and the growing indebtedness of recipient countries.[25/]

These obstacles give rise to problems which have been catalogued as follows: inadequate basic infrastructure; high transport costs; lack of cheap energy; limited size of the market; surplus production capacity; absence of an organized class of

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26/ John H. Adler, Absorptive Capacity: the Concept and its Determinants (Brookings Institute, Washington, D.C., June 1965) quoted in the UNCTAD report.

27/ Willy J. Stevens, Capital Absorptive Capacity in Developing Countries (A.W. Sijthoff, Leiden, 1971), quoted in the UNCTAD report.

25/ (See page 9).

entrepreneurs and managers of enterprises; shortcomings in the area of industrial project identification, planning and evaluation; insufficient economic and industrial research; lack of financial and credit resources; shortage of technically trained personnel; import controls and protective tariffs; competition from large neighbouring countries; conflicts between economic and social objectives; inadequate institutional infrastructure; lack of rational management techniques in both the public and private sectors; delays in the execution of projects by organizations of the United Nations system; inadequate industrial information (in all its forms); insufficient technological research; high production costs.[28] Regarding certain of these points some further comments would seem in order.

Recent experiments[14] have pointed to the existence of other obstacles.

1. Inadequate articulations between planning and the industrial projects.

In many, even relatively developed, countries, there are no real sectoral policies. As a result, an enormous gap exists between the general guidelines of economic and social planning and the projects for the establishment of enterprises.

2. The absence of any industrial and technological policy-making function and, thus, of an industrial policy.

This fact has been revealed by recent studies[29] which show that in most cases the implicit instruments of industrial policy run counter to a national scientific and technological policy. Little use is made of the explicit instruments.

3. In most of the developing countries the scientific and technological system (STS) is "non-structured" and "non-functional".[30]

The STS is non-structured because it is unrelated to the needs of society. There is relatively too much emphasis on basic and applied research at the expense of experimental development. This research is concentrated in a limited number of sectors

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28/ Seminar on UNIDO Operations for the Least Developed Countries in Africa, Addis Ababa, 15 January 1973.

14/ (See page 6).

29/ Science and Technology Policy Instruments (STPI Project).

30/ Schiller Thébaud, "Les 'systèmes' de recherche scientifique et technique des pays en voie de developpement", ("The systems' of scientific and technical research in developing countries") in Le Transfert de Technologies (The transfer of technology), Revue Tiers-Monde, January-March 1976.

and regions, with most of it conducted outside industrial enterprises. The system is "non-functional" because it is too loosely linked to the other sectors of society, and its results generally fail to reach the public at large. It contributes little to economic and social development. The STS depends on external links and lies outside the process of decision-making among enterprises concerning the transfer of technology.

4. The principal obstacle to the organization of the transfer and development of technology has been found to be lack of co-ordination in the institutional sector.

Contacts between the scientific and technical infrastructure and the production sector are more easily established than with government agencies.15/

5. The lack of co-ordination found at the level of national systems carries over to the level of international organizations.

The segmentation of these organizations corresponds to the "patron-client" relationship that has grown up with specific national institutions.

The process is as follows. The international organizations receive their mandates from national institutions that are not part of any co-ordinated system. In exchange for these mandates they provide services which reinforce the powers of particular institutions that are usually at loggerheads with one another. The dividing up of programmes and distribution of functions within the international organizations are themselves the result of competition and conflicts. In turn, the administrative mould determines the shape of national projects. The process has thus come full cycle.

Often the assistance provided by international organizations tends more to aggravate this lack of co-ordination at the local level than to correct it.31/ 32/

The aim of "integrated and self-sustaining socio-economic development" has as a corollary the need for the fragmentation of the United Nations system to be eliminated33/ and for the poor internal articulation between the different international organizations to be rectified.

15/ (See page 6).

31/ Pierre F. Gonod, "Le contrôle social de l'offre externe de technologie", seminar of OECD on Science, Technology and Development in a Changing World, 21-25 April 1975.

32/ Pierre F. Gonod, Le transfert technologique et la coopération inter-américaine pour le developpement, Washington, October, 1976.

33/ A New United Nations Structure for Global Economic Co-operation, Report of the Group of Experts on the Structure of the United Nations System, United Nations, New York, 1975.

6. In the more advanced developing countries the establishment of new enterprises frequently runs into obstacles in the form of the vested interests of national, regional or local monopolies or oligopolies. A thorough analysis based on an activity classification system with three or four levels of differentiation can reveal unsuspected degrees of production concentration.34/

7. Loans granted by the international banking system generally leave little available fresh foreign currency for the local authorities to administer as they see fit. The greater part of the loan is assigned to imports of goods and services.35/

8. The dominant behaviour of the businessman in developing countries is also one characterized by the aim of minimizing risks.

This encourages the tendency to purchase "packaged" technology including licencing arrangements, know-how, technical assistance, management and other after-sale services. The entrepreneur will generally prefer the security of the package to the risks involved in seeking other technical combinations that make wider use of national inputs.36/ If these operations take place in the absence of any genuine competition, there are no economic penalties for ill-advised technological investment.

9. The mistaken notion that the third world constitutes a single undifferentiated bloc of countries leads to an uncritical transfer of industrialization methods that are inappropriate to the least developed countries.25/

"There is a need to establish an operational typology of the least developed countries based on the deficiencies in the integration of their economies (systems of prices, investment flows and information) according to the forms and extent of their domination from abroad and with allowance for the various causes contributing to the wasting of human resources (for example, too high or too low a population in relation to local resources). Such studies, conducted by all the interested parties and subject to their control, would provide a basis for well-considered policies going beyond a purely commercial approach to technology".37/

34/ Gabriel Misas A., Contribución al estudio del grado de concentración en la industria colombiana, Ediciones Tiempo Presente, Bogotá, 1975.

35/ Arturo Infante V., Función y naturaleza del endeudamiento externo, Tercer Mundo, Bogotá, September 1974.

36/ Pierre F. Gonod, "Conflit-coopération dans le tranfert technologique", Mondes en Développement, No. 14, 1976.

25/ (See page 9).

37/ Francois Perroux, "L'ordre international nouveau", Revue des Etudes Coopératives, 3rd quarter 1976.

D. SOME CONSEQUENCES FOR PRACTICAL ACTION (PRAXEOLOGICAL CONSEQUENCES)

By considering the target system of the UNIDO Plan of Action together with the related obstacles it is possible to arrive at certain guiding principles on which to base an action methodology.

1. International technical assistance should not inhibit the mobilization of local resources, but on the contrary should promote self-reliance, which has been defined as "relying on one's own strength, one's own resources, one's own capital and the creative talents of one's own people".[18/]

Operational consequences: (a) A clearer identification in diagnostic surveys of: (i) the capacities of the active unit and of its environment and (ii) the structural obstacles; (b) orientation towards an "action-based survey" approach.

2. The goal of integrated and self-sustaining socio-economic development implies:

Operational consequences: (a) An integrated diagnostic methodology including: (i) a survey of existing capacities and the conditions for mobilizing them, (ii) the identification of the points at which the project's active unit is well articulated, or poorly articulated, with its environment, and (iii) the identification of the implicit and explicit instruments of national industrial policy; (b) integrated technical assistance and training projects suggested by analysis of the weaknesses of the active units and their needs taking into account the characteristics of industrial projects.

3. The ability to master the complex interdependent relationships involved - a skill which currently only the large industrial engineering firms can offer - is a long-term objective for the developing countries.

An intermediate goal might be for the authority responsible for the project (finance corporation, public or private enterprise, etc.) to be thoroughly familiar with the interdependent relationships between options - as regards the legal and financial structure of the enterprise, selection from among technological alternatives, and the choice of partners for the transfer of technology.

18/ (See page 6).

The new economic order implies the incorporation of technology in projects not as something predetermined but as a variable.

Operational consequences: (a) Simultaneous choices, made through a series of steps, within the three above-mentioned areas; (b) obtaining of operational information of a technical, economic and commercial nature, particularly when undertaking new activities; (c) obtaining of information on financing possibilities and offers of co-operation; (d) application of project evaluation methods based on several criteria; (e) strengthening, in particular, of the national capability in the area of engineering studies in order to ensure correct decisions at the stage of project prefeasibility studies.

4. Within the framework of the new economic order the role of international technical assistance can no longer be limited to facilitating direct contacts between companies of industrialized and developing countries and ensuring the exchange of information.

This role should be expanded so as to include help in correcting structural asymmetries and contributing to improved co-operation through assistance in the negotiation of industrial arrangements[38/] to enable the active units in developing countries to enlarge their operating space. Such aid would imply more than simply "services" and would consist in an action methodology and information.

Operational consequences: (a) The formulation of a methodology for arriving at industrial arrangements based on the relative strengths and capacities of the partners, and (b) the provision of technical assistance in this area.

5. The "technology diplomacy" of the developing countries[39/] should aim at creating conditions for deferring any financial commitment for as long as possible in the planning of industrial projects. In this way, one arrives at a financial strategy that is linked to the selection of technological alternatives and partners and the creation of competition among investors and suppliers of technology.

38/ Industrial arrangements range, according to the relative strength of the partners, from simple licensing agreements through co-production agreements, functional agreements and compensation agreements, to complementarity agreements. See J.N. Behrman, Decision Criteria for Foreign Investment in Latin America, Council of the Americas, 1974.

39/ "Technology diplomacy" can be defined as the co-ordinated set of policies pursued in the foreign relations of a country or group of countries, to obtain the technology required to achieve political objectives. Pierre F. Gonod, Clés pour le transfert technologique (op. cit.).

Operational consequences: (a) A shift of emphasis in the concept of the prefeasibility study, whose real purpose in most cases is to attract the capital needed to finance a project immediately by demonstrating that it can be expected to yield a profit; (b) the avoidance of tied loans or the easing of constraints on their provision; (c) the strengthening of pre-investment financing; (d) access - especially in the least developed countries - to intensified technical assistance in the area of prefeasibility studies.

6. As far as possible, preference should be given to the expansion of internal capacities contributing to the execution of the project. Transfers of technology from abroad should be considered with reference, on the one hand, to specific objectives relating to the expansion of internal capacity, and on the other to the needs of the project.

Transfers of technology from abroad should cover: (i) training to enhance internal capacity, and (ii) services connected with project planning and implementation activities.

Operational consequences: (a) The programme to expand internal capacity and the apportionment of external transfers of technology become the "output" of strategic decisions taken with regard to the various interdependent factors; (b) to the degree that these decisions are coherent, they will ensure similarly coherent assistance projects that address specific needs and are well integrated.

7. Because of the close ties that frequently exist between engineering firms, the holders of rights to technical processes and equipment manufacturers, selection of the engineering firm is tantamount to selection of the technological process as well. The order of operations must be reversed if there is to be a real choice.[15]

Thorough familiarity with the interdependent aspects of the problem during the prefeasibility study phase implies that external engineering assistance for the planning of the project (and in some cases its execution) will be sought following an evaluation (or preliminary evaluation) of the technological alternatives by the authority responsible for the project.

15/ (See page 6).

Operational consequences: (a) The ascertaining, with the help of technical, economic and commercial information, of the ties existing between engineering firms, the holders of rights to technological processes and equipment producers; (b) obtaining of international technical assistance to ensure a fuller understanding of the strategic choices.

8. Forms, proportions, channels and agents of technology transfer depend on the relative strength of the partners.[36]

There is thus considerable variation in the fields of action open to active units in the industrialized, developing and least developed countries. Different levels of action must, therefore, be considered if the errors of an uncritical approach to the transfer of technology are to be avoided. For each level of action there is a corresponding "level of consciousness"[40] and special instruments.

Operational consequences: The formulation, following on from development typologies and integrated diagnostic surveys, of a typology of levels of action and their corresponding instruments.[41]

9. International technical assistance, which for 30 years has been based on incrementalism and empiricism, has reached an impasse.

To break out of this impasse, new tools for action must be devised.

Comprehensive typologies are required to overcome the dilemma of "arrogant globalism" and "incrementalism" and to discover those key points in the mesh of interdependent factors[42] on which action can be effectively concentrated.

It takes time to devise these important tools for analysis and action. UNESCO needed eight years to prepare the SPINES thesaurus.[43] The result has been a lasting work which specialists can use as a valuable tool. As the Chinese proverb says, "the longest journeys are often the shortest".

36/ (See page).

40/ The term "level of consciousness" means the set of aims and objectives common to the policy-makers responsible for technological and industrial development policy. For example, eight degrees of consensus in technological policy-making at the national level have been defined (see Clés pour le transfert technologique, op. cit.).

41/ Mention should be made here of an interesting paper on the typology of the scientific and technical infrastructure in Latin America: V. Davidov, in Problemas de la revolución científica, Academia de Ciencias de la URSS, Ediciones Suramérica, Bogotá, 1975.

42/ M. Crozier, La société bloquée, Editions du Seuil, 1972.

43/ Science and Technology Policies Information Exchange System (SPINES), UNESCO.

Operational consequences: (a) The undertaking of work on the typological correspondences between industrial production systems and management characteristics;[44/] [45/] (b) study of the typological correspondences between the stages of technical progress and work functions;[46/] (c) formulation of a typology of technologies - that is, the laws of composition of modular typologies;[47/] [48/] [49/] [50/] (d) the preparation of a map of technological paths - or technological network diagram[51/] - to provide a graphic guide to the routings and acquisitions required for advancing from a mastery of simple technologies to a more sophisticated level.[52/]

Such a map would be of enormous interest as an operational tool. It would enable the developing countries to set deliberate technological development targets.

10. In their "technology diplomacy" the developing countries should strive to develop the logistic data base required for the new policies and "rules of the game" implicit in the new economic order and the target system of the UNIDO Plan of Action.

44/ Joan Woodward, Industrial organizations: Theory and Practice, Oxford University Press, 1965. Joan Woodward has pointed out the way in which the production system (resulting from the combination of technology and market - for example, production to specifications, mass production, continuous production) affects the management and organization of an enterprise.

45/ James S. Thompson, Organizations in Action, McGraw Hill Book Company, 1967. Thompson discusses the organizational consequences of three types of technology: long-linked technology, mediating technology and intensive technology.

46/ Auerhan, Technika, kvalifikace, vzdelani, Prague, 1965 (in Radovan Richta's La civilisation au carrefour, Editions Anthropos, 1972). The author illustrates the correlations between the stages of technological progress and the functions of labour.

47/ As early as 1867 Karl Marx, in Capital, deplored the absence of a critical history of technology.

48/ An effort to establish a simple typology has been undertaken by G.R. Hall and R.E. Johnson, The Rand Corporation's Transfers of U.S. Aerospace Technology to Japan, NBER, 1970.

49/ Hasan Ozbektan has proposed the idea of establishing a "periodic table of technologies", referred to by Erich Jantsch in Design for Evolution, International Library of Systems Theory and Philosophy, George Braziller, New York, 1975.

50/ Pierre F. Gonod, "New challenges in technology transfer", World Technology, May 1975.

51/ Methods based on the concept of a network are used in technological forecasting according to a procedure called "mission taxonomy", - that is, "a logical breakdown showing the logical interrelationships among missions from greater to lesser inclusiveness". Robert U. Ayres, Technological Forecasting and Long-Range Planning.

52/ Work has been done in this direction in the military field in the United States. See M. Cetron, "Quest Status Report", Institute of Electrical and Electronics Engineers (IEEE), Transactions on Engineering Management, March 1967.

Experience[14] shows: (a) the need for the preparation of technical, economic and commercial (TEC) information of a new type so that countries can enter new areas of activity, and (b) the feedback from the evaluation of technological alternatives to the assembly and processing of information.

Not only must the information system be designed for different users, but attention must also be given to the way the information is used in the decision-making process.[53]

Not enough consideration has been given to the importance of the "structural" content of information[54] in studies on the establishment of technological data banks.

Operational consequences: (a) The establishment of TEC data of a developed type; (b) consideration, when establishing technological data banks, of the operational implications of the structural content of the information and the way it is to be used in the evaluation of technological alternatives.

11. The real problem is to set up a mechanism not only for evaluation but also for decision-making in the process of selecting from among technological alternatives. International technical assistance must be able to offer "something else" beyond the purveying of information in a raw state. What must be provided is information that becomes part of the power and decision games of the decision-maker, enterprise or public authority. Information must thus be processed in such a way as to be usable as guidance in reaching decisions with respect to the transfers involved in industrial projects. The breakdown of the variables into constraints, decisional variables and variables of decisional influence is in line with this objective[55] [56] and corresponds to the maximum operating space, operating space and decision space of active units.[17]

14/ (See page 6).

53/ German Framignan, Pierre Gonod, Carlos Martínez Vidal, "Información para la transferencia de tecnología como proceso incentivador del desarrollo technológico", 38th World Congress of the International Federation for Documentation, Mexico D.F., 27 September-1 October 1976.

54/ D.M. MacKay, Information, Mechanisms and Meaning, Cambridge, Mass., 1969.

55/ P.F. Tenière-Buchot, "Une tentative d'analyse du système "eau" dans une agence financière de bassin", Futuribles, February-March 1973.

56/ Pierre F. Gonod, Recherche d'une stratégie d'évaluation progressive des technologies. Le mécanisme d'évaluation et de décision pour la sélection des technologies (M.E.D.E.S.T.), PPTT/OAS, August 1973.

17/ (See page 6).

Operational consequences: (a) New methodologies also permit fresh approaches to technological assessment and international technical assistance; (b) the splitting up of the technology problem into constraint variables, decisional variables and variables of decisional influence could make it possible to do part of the information work in different places at different times; (c) a qualified expert, where one is to be found, can always isolate the constraints in a particular technical system; he can also provide initial guidance regarding the decisional variables and the decisional influence variables; (d) the evaluation method becomes an instrument for national policy-making, for reaching consensus decisions, for seeking specific compromise solutions with enterprises, and, in the last analysis, for participation.

12. The new economic order implies a revision of project evaluation methodology.[57/] [58/] The methods derived from the neoclassical and marginalist school do not permit consideration of factors which, in the light of the present crisis of civilization in the industrialized countries with market economies, are becoming of decisive importance today.

To mention only a single example, the manipulation of rates of discount leads to problems that are not always perceived.[59/] [60/]

57/ I.M.D. Little and V.A. Mirrlees, Manual of Industrial Project Analysis in Developing Countries, OECD Development Centre, Paris, 1969.

58/ Partha Dasgupta, Amartyz Sen and Stephen Marglin, Guidelines for Project Evaluation, UNIDO, New York, 1972.

59/ High discount rates favour projects that yield a short-term return, and low rates those that yield a long-term return (see Pierre Massé and Pierre Bernard, Les dividendes du progrès, Editions du Seuil, 1969). Prevailing interest rates naturally affect discount rates. Thus, structural realities and the almost usurious rate of interest lead to high discount rates. The disarray in the world monetary system accentuates this phenomenon. As a result, internal and external causes converge to encourage low-risk operations offering a high return over the short term.

60/ In addition, it should not be overlooked that the discount rate functions not only as a screen to assist in selection but also as a vehicle for the transfer of incomes (cf. Pierre Massé and Pierre Bernard, op. cit.), so that, in the final analysis, raising the interest rate means transferring a larger part of the national income to the propertied classes - that is, the creation of a new income concentration mechanism (cf. Celso Furtado, Les Etats-Unis et le sous-développement de l'Amérique Latine). Planners are not always aware of this contradiction.

Operational consequences: (a) Orientation towards the development of project evaluation methods based on many criteria;[12/] [61/] (b) in line with this, the methods for technology evaluation (see above) would be an integral component of a general methodology for multi-criterion project evaluation.

12/ (See page 5).

61/ See the efforts along these lines of Charles Prou and Marc Chervel, Etablissement des programmes en économie sous-développée, tome 3: L'étude des grappes de projets, Paris, 1970; and Chervel, L'évaluation des projets de production en économie sous-développée, SEDES, Paris, January 1974.

II. CHANGES IN OPERATIONAL METHODS AND REDEPLOYMENT OF INTERNATIONAL TECHNICAL ASSISTANCE

The attached diagram is an attempt to translate the above-praxeological principles into specific terms.

The steps involved in an industrial project (numbered from 1 to 29) follow the usual logical order but incorporate the 12 principles for reviewing the methodology of the operation.

The points to be taken into account in the study of the capacities of the active unit and its environment are catalogued with the letters a to k. Increases in internal capacities and the corresponding external technology transfers are classified from a' to i'.

The services which will be taken care of by international technical assistance (ITA) are classified from A to R.

Only a brief commentary will be given on this diagram... The point of departure is the "project idea" 1. The complex questions of the identification of demand and its formulation, and the existence of points of combination and reduction, have been deliberately left aside. These questions fall within the ambit of the national organized mechanisms for technology transfer and the functions involved in contacts with enterprises.

Items 2 and 3 relate to the exploratory technical and commercial "plausibility" study. 62/

The information obtained from ITA under items 2 and 3 relates to raw information on possible technological processes, and general information on the markets for the products concerned.

62/ The term "plausibility" has been borrowed from José Giral (op. cit.) more with the purpose of indicating a change in general tendency than of suggesting a modification of the method usually followed in the drawing up of projects.

"'Plausibility criteria' refer to social benefits for the nation as against 'feasibility criteria' which are based on purely economic considerations".

It may be added that this distinction is not essential here.

UNIDO already provides these services, so that no organizational innovation is proposed.

Items 4 and 5 relate to the exploratory study of the characteristics of products and comp nents, and the exploratory determination of the essential variables for the project: volume of activity, size of the enterprise, order of magnitude of unit costs of products and efficiency indicators.

The determination of the characteristics of products and components is often effected in iterations using the information received. The preliminary choices are not irreversible in nature. The study of technological alternatives, 6, may bring to light new possibilities or eliminate solutions that had seemed possible. Similarly, the initial fixing of possible volumes of output, orders of magnitude of unit costs for the product or products and references to efficiency performances of comparable cnterprises are not of an irreversible character.

Already in the exploratory study, account is taken of resources available locally in regard to: management (a), marketing (b), technical capacity (c), industrial engineering capacity (d), capacity for the production of raw materials (e), and capacity for the production of capital goods (f).

ITA ensures the provision of the information C and D. Thus UNIDO must provide a certain amount of information on the products and their components. On the other hand, information on the essential variables may be harder to obtain.63/

Items 6, 7 and 8 concern the analysis of the iterative choices that have to be made between the technological alternatives, recourse to various agents of technology transfer, and the legal and financial structure of the project.

ITA services acquire exceptional importance and new significance at this stage.

The study of technological alternatives under 6 is facilitated by the provision of "elaborated" TEC information (E). It depends also on assistance in the utilization of methodologies for the evaluation of technological alternatives (G), and, in the long term, the availability of typologies of technologies (K) and technological maps (L), explicitly permitting the selection of technological targets.

The analysis naturally takes into account local possibilities as regards education and technical training (h), national scientific and technical research capacities (g) and labour supply (i).

63/ The publication by UNIDO of "profiles" of industrial establishments containing data of this kind has not been continued.

The simultaneous study of possible forms of partnership with agents of technology transfer utilizes TEC information (E) and information on local technical capacity (c) and industrial engineering firms (d).

The study of possible types of legal structure for the project depends on: general political guidelines when these exist, TEC information (E), industrial co-operation offers (F), and information on sources of financing (I). An input for the latter is the "structural" study (k) concerning the situation of the operating unit in its surrounding context and the articulation or lack of articulation in the various components of the contextual system.

This structural study will cover: (i) the price network; (ii) the network of inter-industry flows; (iii) the information network; (iv) the system of institutions; (v) the study of concentration in production channels on the input side and on the output side of the operating unit and within its activities; (vi) centres of power which may limit or interfere with its operating space; (vii) the implicit and explicit instruments used in industrial policy.

Technical assistance to carry out this analysis is provided by ITA services, which co-operate with the parties concerned in developing the methods and procedures for the operation (O).

Information on industrial co-operation offers (F) and sources of financing (I) are examined by ITA services in the light of financing capacities (j) and the various capacities of the operating unit, in order to evaluate, in terms of the respective strengths and weaknesses of the source or sources of technology and investment and those of the recipient, the best possible combination for the latter. The activity relating to the methodology and strategy with regard to industrial arrangements (H) will thus be an essential type of ITA for the purpose of the analysis of the legal and financial structure of the project (6).

Items 9, 10 and 11 concern the selection, respectively, of the basic technology, of the combination of agents of technology transfer and of the legal structure of the project and of the enterprise, is one to be set up.

Item 12 relates to the attempt to formulate a strategy for the financing of the project, taking into account all the information analysis involved in the

the preceding stages. This means, in particular, considering the strategy for encouraging competition among potential investors (F) and partners for technology transfer (7), and increasing the latitude for decision-making in the utilization of sources of financing. (I).

Item 13 concerns a possible security investment, national or international in nature, to permit the study of the project to begin.

Item 14 is the study of compatibilities between the individual options (9), (10) and (11) and the financing strategy, and the formulation of internally consistent variants for the project.

Item 15 is the decision on the general structure of the project, assisted by reoriented methodologies (J).

On the basis of this decision, which brings the first stage to an end, two series of negotiations can begin: the first to complete the financial discussions, 16, and the second to decide in broad terms on the ITA needed for increasing internal capacities (a' to i') and the projects (P) for transferring internal capacities (Q).

With ITA and the financial and technical partners, the general outlines of the external technology transfers to be effected will also be negotiated.

Naturally, the formulation of the final project may involve changes in the arrangements envisaged.

Item 17 relates to the target system of the project resulting from the choice taken under 15. The final project may involve changes in this, but it is important for the actual formulation of the project that a clear framework of objectives should be established.

Item 18 concerns the appointment of the manager. If information were available on the correspondences between production systems and management (M), it would of course be possible to draw up a desirable "profile" for the manager, and this would facilitate his recruitment.

The scheme could be varied to allow for the recruitment of the manager before the final study, 14, so that he could take part in the strategic choices. In some cases, that approach may offer advantages.

The recruitment of the consulting engineers, 19, who will be responsible, usually, for formulating the project, 20, is consequent on the choice of agents, 10, and the choices regarding interrelationships with 9 and 11. The design of the project, 20, includes the design of the organizational system. This could be facilitated by information on the correspondences between systems of production and management (M). The detailed project, 23, implies the final plan, the layout of shops, machinery and work stations and the fixing of standards.

Items 21 and 22 relate to manpower recruitment and training. Research on correspondences between stages of technical progress and work functions, and on the ergonomics of work stations, would doubtless facilitate a dual adaptation of man to work and work to man. These operations must therefore begin at quite an early stage, though observations made during the training period may lead to modifications in the detailed project.

Item 25 relates to negotiations on the procurement of equipment, influenced by the choice both of the project engineers, 19, and of the agents of the technology transfer, 10.

The procurement phase, 24, is facilitated by TEC information (E).

Items 26, 27 and 28 correspond to the stages concerned with plant assembly, preliminary start-up and the beginning of operations, the full operation of the plant, and efforts to improve its productivity.

Item 29 is an evaluation of the methodology used for the preparation of the project and the technical assistance received. Its results are "memorized" both by the services responsible for TEC information (E) and by those responsible for industrial arrangements (H).

Within this new conception of ITA, a technological data bank would include all the information files symbolized in the outline by a square with a cross in it (A, B, C, D, E, F and I).

The way this would operate is not considered here.

Another consequence flows from this conception for the <u>redeployment of ITA</u>.

Experience (see reference 14) has confirmed the frequently expressed view that a structure of services by functions is inefficient. Co-ordination is difficult, particularly where relatively complex schemes of operation are concerned.

Innovative structures are those where responsibility is delegated by project, from the beginning of operations to the end.

Translated into operational terms, this means that the "horizontal" structure of UNIDO services - corresponding to the various steps in the progress of a project - must be supplemented with "vertical" responsibility, personalized by project. The latter would play the role of an intermediate structure between the actors in the field and the headquarters services. It would be responsible for co-ordinating the "demand" of the former and obtaining the supply of information, methodology and assistance from the latter in all matters connected with the ITA offered by UNIDO.

The solution proposed links up to some extent with the function of "architect of the system" discussed by J. Melèse (21).

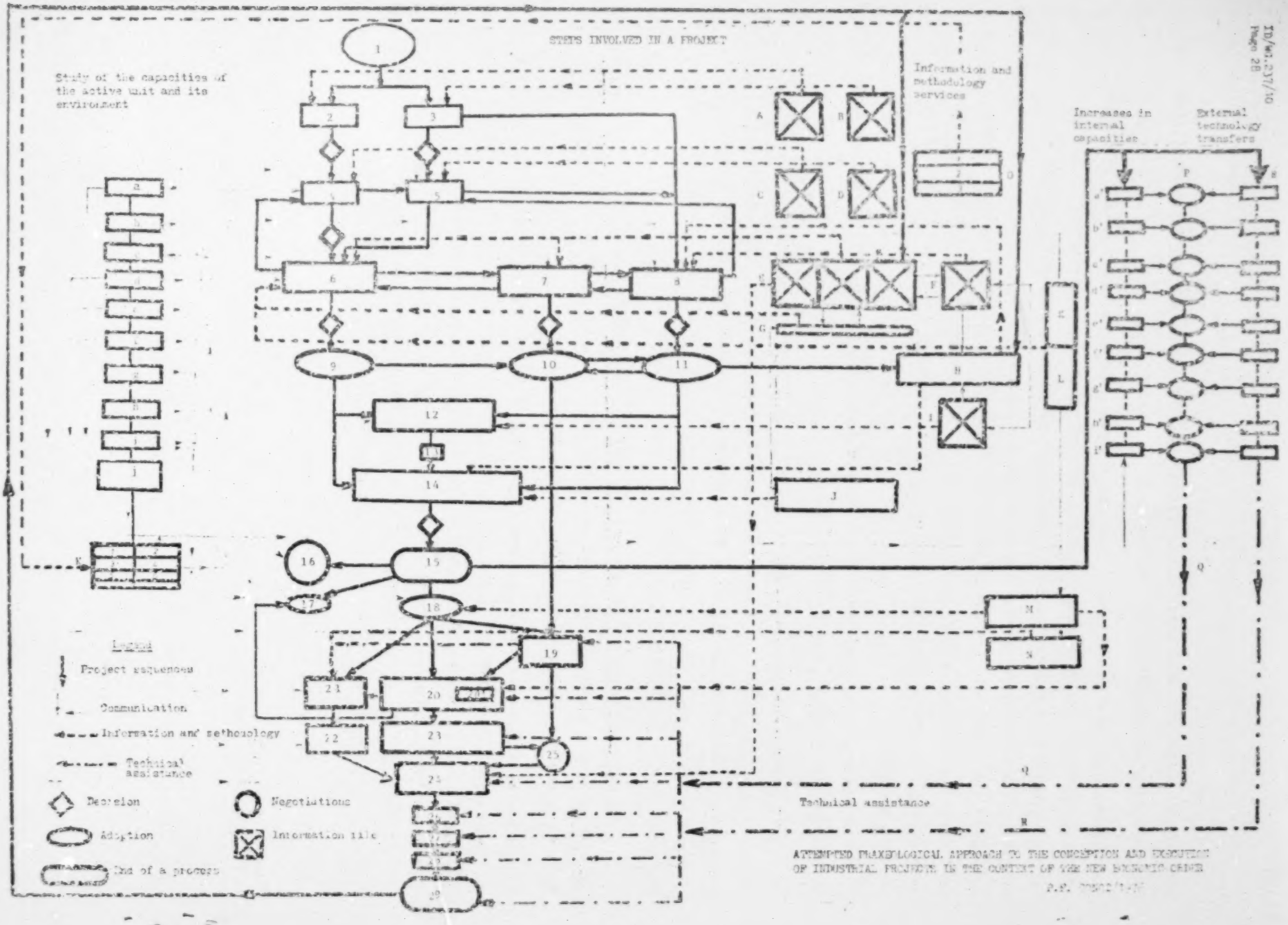
This general idea opens up other possibilities also. As suggested in the UNCTAD study (op. cit.), it would encourage the replacement of projects by programmes. Thus similar projects in a number of countries could give way to programmes which would be organized partly on a joint basis, or at least to common services as far as ITA is concerned.

A systematic inventory of projects of developing countries for embarking on new activities would make it possible to concentrate the preparation of TEC information and, to a certain extent, anticipate coming requests.

Some of these projects may show a high degree of interdependence with interests of industrialized countries. It will be seen that, under these circumstances, favourable conditions would be created for more effective negotiations on access to information, financial conditions and technology transfer arrangements.

Naturally, the scheme suggested allows for many variants and adaptations, based, for example, on the specific characteristics of the activity concerned.

21/ (See page 7).



ATTEMPTED PRAXEOLOGICAL APPROACH TO THE CONCEPTION AND EXECUTION OF INDUSTRIAL PROJECTS IN THE CONTEXT OF THE NEW ECONOMIC ORDER

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NOMENCLATURE

I. STAGES OF A PROJECT

1 - Project idea

2 - Exploratory study as to technical plausibility (or technical prefeasibility study)

3 - Exploratory study as to commercial plausibility (or commercial prefeasibility study)

4 - Determination of the characteristics of the products and components

5 - Exploratory determination of the essential variables: volume of activity, size of the enterprise, order of magnitude of unit costs of products, efficiency indicators

6 - Evaluation of technological alternatives

7 - Evaluation of alternatives for association arrangements with agents of technology transfers

8 - Evaluation of the alternatives for the legal structure of the enterprise

9 - Selection of the basic technology

10 - Selection of the combination of agents of technological transfer

11 - Selection of the legal structure of the enterprise

12 - Working out of a financing strategy

13 - Security pre-financing (national or international)

14 - Study of compatibilities of individual options and variants

15 - Decision on the general structure of the project

16 - Completion of financial negotiations

17 - Decision on the target system of the project

18 - Recruitment of the manager for the enterprise

19 - Recruitment of the consulting engineers for the design and/or implementation of the project

20 - Formulation of the project

20' - Deciding on the organization and methods of management

21 - Manpower recruitment

22 - Manpower training

23 - Formulation of the detailed project

24 - Procurement of plant and equipment
25 - Final negotiations for the purchase of plant and equipment
26 - Assembly of the plant
27 - Preliminary start-up and beginning of operations
28 - Operation, and efforts to improve productivity
29 - Evaluation of the methodology used for project preparation and the technical assistance received

II. ELEMENTS IN THE CAPACITIES OF THE ACTIVE UNIT AND ITS ENVIRONMENT

a - Management capacities
b - Marketing capacities
c - Technical capacities
d - Local industrial engineering capacities
e - Capacities for the local production of capital goods and equipment
f - Capacities for the local production of raw materials and ancillary materials
g - Local scientific and technical research capacities
h - Local educational and technical training capacities
i - Local labour supply
j - Local availability of financing
k - Integration structure of the active unit in its context

k_1 - Articulation or lack of articulation of the price networks
k_2 - Articulation or lack of articulation of the inter-industry flows
k_3 - Articulation or lack of articulation of information
k_4 - Articulation or lack of articulation of institutions
k_5 - Concentration in production channels
k_6 - Identification of the centres of power
k_7 - Identification of implicit and explicit industrial policy instruments

III. INCREASING INTERNAL CAPACITIES AND EXTERNAL TECHNOLOGY TRANSFERS

The letters a', b', c', d', e', f', g', h' and i' correspond to the above items.

The increase in internal capacities ($\triangle^a$) results from external technology transfers (R) effected in specific training projects (P) in such a way that $a' > a$, $b' > b$, etc...

IV. INTERNATIONAL TECHNICAL ASSISTANCE

A - Information on technologies (not elaborated)

B - Information on markets for products

C - Information on the characteristics of products and their components (not elaborated)

D - Information on the essential activity, cost and efficiency indicators

E - (Elaborated) information of a technical, economic and commercial type for entry into new activities

F - Files of industrial co-operation offers

G - Methodology for technology evaluation

H - Methodology and strategy with regard to industrial arrangements

I - Files of information on sources of financing

J - Multi-criterion methodology for project evaluation

K - Typology of technologies

L - Technological "maps"

M - Typology of "technology-management" correspondences

N - Typology of correspondences between stages of technical progress and work functions in the enterprise

O - Methodology for an integrated study

O_1 - Survey of capacities (a), (b), (c), (d), (e), (f), (g), (h), (i) and (j)

O_2 - Identification of the structures as regards the integration of the active unit in its environmental context; articulation and lack of articulation

O_3 - Identification of explicit and implicit industrial policy instruments

P - Specific projects to increase internal capacities

Q - Transfer of internal technical capacities

R - External technology transfers